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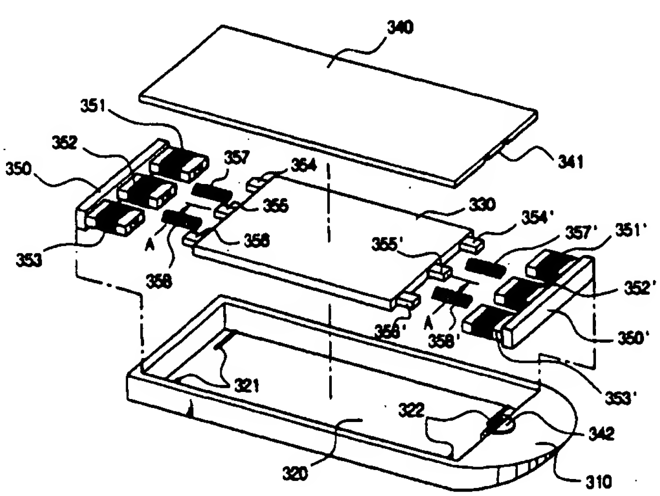

(57) Abstract

The present invention discloses a storage battery pack in capable of portably charging a portable electronic appliance. The storage battery pack includes a case detachably mounted on a portable communication terminal equipment; a means mounted on the case for generating induced electromotive force by means of an external movement exerted on the case; a charge control circuit mounted on the case for adapting the induced voltage to the charging of a secondary battery, the battery being mounted on the case and electrically connected to the charge control circuit; and an electrical connection means exposed on the outer surface of the case and electrically connected to the charge control circuit. The electrical connection means is in contact with a contact of an electronic appliance when the storage battery pack is mounted on the electronic appliance.

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PORTABLE POWER-SUPPLY UNIT AND PORTABLE ELECTRONIC APPLIANCE IN WHICH THE POWER-SUPPLY UNIT IS INCORPORATED

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a portable power-supply unit for a portable electronic appliance and a portable electronic appliance in which the power-supply unit is incorporated.

More particularly, the present invention relates to a portable unit of inducing and charging electrical energy, the unit which induces an electrical energy by means of natural or artificial vibration energy and charges a secondary rechargeable battery with the induced electricity.

Further, the present invention relates to the portable power supply-unit in which the unit of inducing and charging electrical energy and the secondary rechargeable battery are incorporated into a simple power module, the power module being coupled to an electronic appliance and stably supplying the electronic appliance with power.

Furthermore, the present invention relates to the portable electronic appliance operated by means of such a power supply-unit incorporated thereto.

The present invention is especially available for a portable communication terminal equipment such as a cellular phone or PCs(Personal Communication System) phone, however, the present invention is not limited to it.

Description of the Prior Art

Generally, an electronic appliance may be classified into the following two categories.

The first is the stationary thing used in a fixed place, and the second is the portable thing which the user can carry and use in any places.

For example, the former is a home television set or a stereo set and the latter is a portable communication terminal equipment such as a cellular phone or PCS phone a notebook-sized personal computer, a portable cassette tape recorder, a portable CD player, etc. Recently, these kinds of the portable electronic appliances are widely used.

In the electronic appliance, a power source is essential for its operation.

The stationary electronic appliance should obtain the power from a place where it is installed so that the place has an electrical outlet such as a plug socket to which a power distribution system connected with a power plant is connected. The user connects the plug of the electronic appliance to the plug socket and the electronic appliance receives the necessary power and operates.

The portable electronic appliance uses mainly a battery as the power source. The user could temporarily use the electrical outlet when he or she stays in a particular place.

However, the battery is recognized as a main power source for the portable electronic appliance as the desire of a human to freely use the appliance in any place where the user moves without any limitation to a particular place is getting increased.

There are two kinds of batteries. One is a dry cell,

which should be wasted after it is once used. The other is a secondary battery such as a lithium-ion battery, which is rechargeable and, thus, can be reused repeatedly after it is all discharged.

The demand for the secondary battery is largely increasing nowadays. The secondary battery needs to be recharged by a charging device when it is all discharged.

The conventional charging device should be electrically connected to the electrical outlet fixed to a particular place in order to obtain electricity and supply electricity to the secondary battery for the charge of the battery. Accordingly, the secondary battery is only chargeable in the particular place where the electrical outlet connected to the power plant through the distribution system is provided. As a result, it is required to charge the secondary battery before the battery is mounted on the electronic appliance to operate the electronic appliance.

Therefore, the user should take care to identify the capacity of the secondary battery and estimate the time when the battery should be replaced with the recharged battery.

If the identification of the capacity of the battery and the estimation to the replacement time are wrong, the user may fail to use the portable electronic appli[illegible]

Particularly, the user of a portable communi[illegible] terminal equipment such as a cellular phone, etc. often experiences abrupt cutting-off of the phone because the capacity of the battery is all exhausted and frustration to use the phone when he or she finds that he or she did not recharge the battery beforehand.

Therefore, a portable power-supply unit which can

induce electricity by itself and charge the secondary battery during the user's movement, is demanded.

The Korean Patent application No. 98-12939 discloses a power-supply unit including a solar-cell plate attached to a battery pack of a cellular phone. This unit induces electricity from the solar energy and charges it into the secondary battery inside the battery pack.

The invention recited in the Korean patent application often fails to efficiently induce and supply the electricity to the secondary battery when the solar energy is not sufficiently available. For example, the cloudy weather or the stay of the user in the room makes the solar energy insufficient. As a result, the invention has a limitation on its use condition.

Therefore, a power-supply unit which can be used without any limitations to the use condition, is demanded. Alternatively, demanded is a portable electronic appliance to which the power-supply unit is incorporated. The present portable electronic appliance eliminates inconvenience that the user should previously estimate the recharging time or the replacing time of the battery before using the portable electronic appliance and maximizes the portability of the appliance.

SUMMARY OF THE INVENTION

The present invention is directed to a power-supply unit and a portable electronic appliance that satisfies these demands.

It is the first object of the present invention to provide a portable power-supply unit which can convert a natural vibration energy caused by the movement of the

user to electrical energy and charge the converted electrical energy into a secondary battery.

It is the second object of the present invention to provide a portable electronic appliance to which the power-supply unit is incorporated so that the appliance operates by means of the power-supply unit.

It is the third object of the present invention to provide a storage battery pack separably mounted on a portable communication terminal equipment by which the user can phone a call at least one more time even when a storage battery in the pack is all discharged.

It is the fourth object of the present invention to provide a portable communication terminal equipment to which the storage battery pack is incorporated so that the portable communication terminal equipment operates by means of the storage battery.

It is the fifth object of the present invention to provide a portable power-supply unit which can convert an artificial rotational energy caused by the user to the electrical energy and charge a secondary battery with the converted electrical energy.

It is the sixth object of the present invention to provide a charge control circuit which can appropriately change a voltage level of an induced electromotive force from a natural or artificial kinetic energy in order to adapt the induced electromotive force to a charge of a secondary battery.

A portable power-supply unit according to the present invention includes a case and means for generating induced electromotive force mounted on the case. The means for generating induced electromotive force has magnetic flux-generating means, a coil electromagnetically coupled to

the magnetic flux-generating means, and moving means for producing a relative motion between the magnetic flux-generating means and the coil by an external movement exerted on the case.

The portable power-supply unit also includes a charge control circuit mounted on the case which can adapt the induced electromotive force generated by the means for generating induced electromotive force to an external circuit by means of the step up of the voltage of the induced electromotive force or rectification.

In this case, the case includes a first room for receiving the means for generating induced electromotive force and the charge control circuit and a second room for receiving a secondary battery. Also, the moving means includes a resilient member for transferring the external movement to vibration and a motion member which takes a vibrating motion by the movement of the resilient member in the first room. A holding plate for holding the magnetic-flux generating means is provided in an inside wall of the first room. The coil is wound round a bobbin attached to the motion member and the bobbin and the magnetic-flux generating means are arranged to be opposite to each other so that they take a relative motion each other to be closer and farther repeatedly according to the vibration of the motion member.

According to another aspect of the present invention, it is possible to form a subcase in the first room in order to accommodate the means for generating induced electromotive force. In this case, the magnetic-flux generating means is a magnet and the moving means is coil springs arranged at both ends of the magnet. The coil is wound round the bobbin which can receive the magnet in its

hollow. Accordingly, when the external movement exerts on the case, the magnet reciprocally vibrates with respect to the coil-wound bobbin through its hollow.

Further, it is possible to arrange a multiple of the means for generating induced electromotive force in series in which the magnet, the coil springs positioned at both ends of the magnet and the coil-wound bobbin through the hollow of which the magnet is capable of reciprocating constitutes the single means for generating induced electromotive force.

According to other aspect of the present invention, the case may include a receiving room for receiving the magnetic-flux generating means, the coils and the moving means. The moving means includes a resilient member for transferring the external movement to vibration and a motion member which takes a vibrating motion by the movement of the resilient member in the receiving room, and the secondary battery and the charge control circuit are mounted on interior of the motion member to be electrically connected to each other. In this case, a holding plate for holding a bobbin round which the coil is wound is provided in an inside wall of the receiving room and a magnetic-flux generating means is attached to the motion member. The bobbin and the magnetic-flux generating means are arranged to be opposite to each other so that they take a relative motion each other to be closer and farther repeatedly according to the vibration of the motion member.

A portable power-supply unit according to other aspect of the present invention includes a case, means for generating induced electromotive force mounted on the case. The means for generating induced electromotive

force has magnetic flux-generating means, a coil electromagnetically coupled to the magnetic flux-generating means, and moving means for producing a relative motion between the magnetic flux-generating means and the coil by an external movement exerted on the case. The portable power-supply unit also includes a charge control circuit mounted on the case which can adapt the induced electromotive force generated by the means for generating induced electromotive force to an external circuit by means of the step up of the voltage of the induced electromotive force or rectification. Further, the portable power-supply unit includes an electrical connection means for supplying a secondary battery outside the case, the means being taken out to exterior of the case.

The charge control circuit incorporated to the portable power-supply unit of the present invention includes a rectification circuit which converts the induced AC voltage from the means for generating induced electromotive force to DC voltage, a voltage-step up circuit for stepping up the level of the rectified DC voltage to adapt to an external circuit and a super capacitor which temporarily stores the voltage stepped up and supplies the stored voltage into the secondary battery. The charge control circuit may further include a supercapacitor for compensation connected parallel to the secondary battery in order to prevent the life span of the charge control circuit from being shortened because of the abrupt all discharge of the secondary battery.

A portable power-supply unit according to the present invention can be incorporated into a battery pack detachably mounted on the body of a portable communication

terminal equipment.

When the present invention is applied into the battery pack, the battery pack includes a rectangular slot formed on an outer side of the battery pack. In the rectangular slot, a resilient member for maintaining vibration energy caused by an external movement exerted on the pack, a magnet, a coil electromagnetically coupled to the magnet are provided. Accordingly, as the pack vibrates, the resilient member vibrates. By the vibration of the resilient member, the magnet connected to the resilient member reciprocates relatively with respect to the coil, which generates induced electromotive force in the coil. The induced electromotive force is stepped up and rectified by a charge control circuit mounted on the pack and charges a battery in the pack.

In this case, a plurality of the rectangular slots provided with the resilient member, the coil and magnet may be formed on the outer side of the battery pack in longitudinally and horizontally.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other features, aspects, and advantages of the present invention will become better understood with regard to the following description, appended claims, and accompanying drawings where:

FIG. 1 is a view showing a general cellular phone in which FIG. 1A is a front view of the cellular phone, FIG. 1B is a rear view of the cellular phone and FIG. 1C is a side view of the cellular phone.

FIG. 2 is a view showing a first embodiment of a portable power-supply unit according to the present invention.

FIG. 3 is an enlarged view showing means for generating the induced electromotive force incorporated into the first embodiment of the portable power-supply unit.

FIG. 4 is a view showing overall circuit about the portable power-supply unit of the first embodiment.

FIG. 5 is a block diagram of the charge control circuit incorporated into the portable power-supply unit of the present invention.

FIG. 6 is an exploded view of a second embodiment of a portable power-supply unit according to the present invention.

FIG. 7 is a perspective view of a bobbin incorporated into the second embodiment of the portable power-supply unit.

FIG. 8 is a top view of the second embodiment of the portable power-supply unit in which its upper cover is removed to show the assembly in the upper receiving room.

FIG. 9 is a bottom view of the second embodiment of the portable power-supply unit to show how a battery is mounted thereon.

FIG. 10 is a side sectional view of the second embodiment of the portable power-supply unit.

FIGS. 11 and 12 are exploded views of means for generating induced electromotive force of a third embodiment according to the present invention.

FIG. 13 is an exploded view of a fourth embodiment of a power-supply unit according to the present invention.

FIG. 14 is a sectional view of a motion member incorporated into the fourth embodiment taken along the line A-A in FIG. 13.

FIG. 15 is a view showing a portable part attached

to a power-supply unit according to the present invention.

FIG. 16 is a view showing a fifth embodiment of a power-supply unit according to the present invention.

FIG. 17 is a view showing a sixth embodiment of a power-supply unit according to the present invention in which FIG. 17A is a view showing the whole structure and FIG. 17B is a view showing the inside of the case.

FIG. 18 is a view showing a seventh embodiment of a power-supply unit when it is used as a battery pack.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

A power-supply unit according to the present invention largely includes a mechanical generating part and an electrical rectifying part.

The mechanical generating part converts a movement or an artificial dynamic kinetic energy of the user to the induced electrical energy by means of electromagnetic induction. The dynamic kinetic energy includes vibration and rotational energy.

The mechanical generating part of the present invention may be integrally formed with a secondary battery or be separated from the secondary battery.

The electrical rectifying part of the present invention stores the induced electrical energy from the mechanical generating part and adjusts the voltage level of the stored electrical energy to adapt it to the power source charging the secondary battery or operating an electronic appliance.

The preferred embodiments according to the present invention will be explained with reference to the accompanying drawings.

A first embodiment

Figs. 1 to 4 show a first embodiment of a power-supply unit according to the present invention.

This embodiment relates to the power-supply unit which is incorporated into a portable communication terminal equipment such as a cellular phone or PCS phone. In this case, the mechanical generating part of the present invention generates induced electrical energy from natural or artificial vibration energy and is integrally mounted on the portable communication terminal equipment.

Below, it will be explained with respect to the cellular phone, which is most popular.

Firstly, Fig. 1 shows general constitution of the cellular phone. Specifically, Fig. 1a is the front view thereof, Fig. 1b is the rear view thereof and Fig. 1c is the side view thereof.

Referring to Fig. 1a, the cellular phone has a case 1 in which the RF circuit (radio frequency circuit) is installed, an antenna 2, a speaker 3, a display part 4, character/number part 5 and a microphone 6.

Further, as can be seen from Figs. 1b and 1c, the cellular phone has a receiving portion formed at the rear side of said case 1 for receiving a secondary battery 8 and the secondary battery 8 is separably combined into the receiving portion.

In the receiving portion of the cellular phone, there is a detachable mounting part 7 for detachably receiving the secondary battery 8 therein. A plurality of charging contacts 9 are formed in the lower part of the secondary battery 8.

Fig. 2a shows a rear view of a cellular phone on which the power-supply unit of the present invention is

integrally formed.

An antenna 11 is arranged in the upper part of a case(10) of the cellular phone and a secondary battery 13 is received into the receiving portion by means of a detachable mounting part 15. On the outer surface of this secondary battery 13(which is a portion to be held by the user's hand), a means for generating induced electromotive force 17 is provided.

As will be explained in detail below, if the user moves with the cellular phone, there occurs up and down vibration in the cellular phone, by which the means for generating induced electromotive force 17 generates electrical energy and charges the secondary battery 13.

Also, the up and down shake of the cellular phone will cause dynamic kinetic energy in the cellular phone, by which the means for generating induced electromotive force 17 generates electrical energy and charges the secondary battery 13. It is useful if the cellular phone is incapable because the battery is all discharged.

The electromagnetic mechanism of generating electrical energy by means of the natural or artificial dynamic kinetic energy and the electrical mechanism of charging the battery with the generated electrical energy are explained with reference to Figs. 3 to 5.

Firstly, Fig. 3 is an enlarged view showing the constitution of the means for generating induced electromotive force 17 that is provided in the outer surface of the secondary battery 13.

As can be seen from Figs. 2a to 3, the means for generating induced electromotive force 17 is received in a receiving space 21 formed in the outer surface of the secondary battery.

The receiving space 21 is a rectangular slot, however, is not limited to it.

The receiving space 21 protects the means for generating induced electromotive force 17 from an external shock and also protects the internal part of the cellular phone from an electromagnetic disturbance caused by electromagnetic induction.

Accordingly, it is preferable for the receiving space 21 to be electromagnetic-protectively coated.

The means for generating induced electromagnetic force 17 received in the receiving space 21 includes electromagnetic induction unit 24 and resilient members 23 attached to both ends of the electromagnetic induction unit 24.

The electromagnetic induction unit 24 generates induced electromotive force by means of natural vibration caused by the movement of the user or artificial kinetic energy of the user.

The electromagnetic induction unit 24 includes a magnet 25 and a bobbin 27 as shown in Fig. 4.

The magnet 25 and the bobbin 27 are mechanically connected to the resilient members 23 respectively.

Accordingly, the movement of the user carrying the cellular phone provided with the means for generating induced electromagnetic force 17 causes vibration and it is transferred to the resilient member 23. The resilient member 23 maintains the vibration and oscillates the magnet 25 and bobbin 17 each other relatively.

If the magnet 25 having a constant magnetic-flux gets closer or farther with respect to the bobbin 27 around which a coil is turned, there is variation of magnetic-flux and electromotive force is induced at both ends of

the coil turned around the bobbin 27. (Faraday's law) Therefore, the movement of the user generates induced electromotive force at both ends of the coil turned around the bobbin 27.

Also, the shake of the cellular phone by the user along B direction as shown Fig. 2 causes the generation of induced electromotive force.

The magnetic flux of the magnet 25 or turn number of the coil on the bobbin 27 is decided by considering the storage capacity of the battery and the weight of the cellular phone.

It is preferred that the resilient member 23 is a coil spring having a large spring constant so that the coil spring can maintain continuously the vibration even if the applied vibration on the resilient member 23 is slight. However, the replacement to an equivalent which can perform substantially the same function in substantially the same way and accomplish the same result, will be possible by a person who is ordinary skilled in the art.

Referring to Fig. 4, the induced electromotive force generated in the coil turned on the bobbin 27 charges the battery 29 through a charge control circuit 30.

The charge control circuit 30 has a voltage regulating circuit which steps up the voltage of the induced electromotive force in order to adapt it to the charging of the battery.

Also, the charge control circuit 30 has a rectification circuit to convert the induced electromotive force from AC voltage into DC voltage.

Fig. 5 shows a block diagram of the charge control circuit 30.

As shown, the charge control circuit 30 includes an AC-DC converter 32, a first DC-DC converter 33, a second DC-DC converter 35, a first super capacitor 34 and a second super capacitor 37.

The first and second super capacitors 34, 37 and the battery 36 have parallel connection with the second DC-DC converter 35, respectively. The AC-DC converter 32 is electrically connected to a generator 31 that is the means for generating induced electromotive force 17 and the second DC-DC converter 35 is connected to an external circuit. Below, elements of the charge control circuit 30 are explained.

The AC-DC converter 32 changes the induced AC voltage from the means for generating induced electromotive force 31 into higher DC voltage.

The AC-DC converter 32 largely includes a voltage step up part for stepping up the voltage and rectification part to rectify AC voltage. The voltage step-up part is required because the voltage level induced on the coil turned round the bobbin 27 is quite low. If the voltage induced on the coil is sufficiently high, this voltage step-up part is not necessary. In this embodiment, a transformer is used to step up the voltage.

The rectification part is a diode bridge rectification circuit to convert AC power to DC power used in an electronic circuit.

The first DC-DC converter 33 steps up the DC voltage supplied from the AC-DC converter 32 into the electric potential of the battery 36.

The first super capacitor 34 temporarily stores the voltage supplied from the first DC-DC converter 33. The first super capacitor 34 temporarily stores the power

generated in the bobbin 27 and supplies the stored power to a circuit of an electronic appliance for its operation or to the secondary battery 36 for its charging.

In the cellular phone to which this embodiment is incorporated, when the phone stays for waiting a call, the necessary power is supplied from the first super capacitor 34 and when the phone is used for a call, the necessary power is supplied from the secondary battery 36. This adjustment of the supply of the power is performed by a microprocessor (not shown)installed in the second DC-DC converter 35. As described, the first super capacitor 34 improves the use of the battery more efficiently.

The second super capacitor 37 is provided to compensate the battery 36. When the external circuit demands in a moment a high voltage(pulse voltage), the stored power in the second super capacitor 37 is supplied to the external circuit. Therefore, it prevents the battery 36 from abrupt discharge and, thus, a life span of the battery 36 is extended one and half or two times longer.

The electrical energy stored in the second super capacitor 37 is supplied from the battery 36 and the external circuit, which is adjusted by the second DC-DC converter 35.

The first and second super capacitors are not different from a general capacitor. However, the super capacitors 34 and 37 include an electric double layer capacitor and their storage capacity is from 1,000 to 100,000 times larger than the general capacitor.

Accordingly, the super capacitor has capacity from hundreds mF to a few F whereas the general capacitor has capacity from a few μF to hundreds of μF.

The second DC-DC converter 35 steps up the voltage supplied from the first super capacitor 34 into the voltage level required to operate the external circuit. Also, the second DC-DC converter 35 supplies the voltage from the first super capacitor 34 to the external circuit and/or adjusts the voltage from the first super capacitor 34 to be used for the charging of the battery 36.

As described above, the charge control circuit 30 primarily converts the AC voltage generated in the bobbin to DC voltage and secondly steps up the voltage to the charging voltage of the secondary battery or operating voltage of the external circuit.

The charge control circuit 30 is not limited to the example disclosed in Fig. 5. The modification will be possible which performs substantially the same function in substantially the same way and accomplishes the same result by a person ordinary skilled in the art.

The charge control circuit 30 can be embodied in the form of IC chip, which is preferable in view of lightness.

In the present embodiment, the means for generating induced electromotive force 17 is provided in the receiving space 21 longitudinally formed on the outer surface of the secondary battery 13.

However, the means for generating induced electromotive force 17 according to the present invention can be provided inside of the cellular phone. Also, it is possible to provide a plurality of the means for generating induced electromotive force 17 in which they are connected parallel to one another. In Fig. 2b, they are arranged laterally on the outer surface of the cellular phone and, in Fig. 2c, they are arranged longitudinally and laterally.

The provision of the plural means for generating induced electromotive force as described above gives advantages of increasing the charging capacity and decreasing the need for the separate power-supply unit. However, it increases the weight of the cellular phone.

The described first embodiment shows a power-supply unit which is incorporates into the cellular phone where means for generating induced electromotive force is installed in the outer surface of a battery pack mounted on the cellular phone.

However, in this embodiment, the magnet, bobbin and spring so on should be mounted on the cellular phone all which increase the weight of the cellular phone.

Therefore, below shows other embodiments which do not largely increase the weight of a portable communication terminal equipment such as a cellular phone.

A second embodiment

Figs. 6 to 10 show a second embodiment of a portable power supply unit 100 according to the present invention.

Fig. 6 is an exploded perspective view of the portable power-supply unit 100 and Fig. 10 is its side sectional view. Fig. 9 is a view showing how a battery 170 is mounted on the portable power-supply unit 100.

The portable power-supply unit 100 has a case 110 and the case 110 includes an upper receiving room 113 and a lower receiving room 115. The upper receiving room 113 is closed by an upper cover 112 which has a detachable mounting protrusion 121 and the lower receiving room 115 is closed by a lower cover 114 having a detachable mounting protrusion 141. The case 110 has detachable mounting portions 122 and 142 to receive the protrusions 121, 141.

Magnet holding plates 105 and 105' are arranged at both internal sides of the upper receiving room 113 as shown in Fig. 6 and fixing steps 101, 102, 101' and 102' are also formed on the bottom surface of the upper receiving room 113 to prevent the holding plates 105 and 105' from escaping toward the central portion.

A motion member 130 is arranged in the upper receiving room 113. The motion member 130 is a rectangular shape plate at both ends of which convex parts 131, 132, 131' and 132' and concave parts are formed. On the concave parts formed by the protrusion of the convex parts 131, 132, 131' and 132', bobbins 151, 152, 153, 151', 152' and 153' around which a coil 107 is turned are attached.

Fig. 7 shows the structure of the bobbin.

As shown, a coil 107 is turned around the bobbin 151 and a hollow portion 108 is formed in the bobbin 151. The hollow portion 108 receives a magnet.

As described later, when the motion member 130 vibrates along its longitudinal direction, the bobbins 151, 152, 153, 151', 152' and 153' attached in the motion member 130 also vibrates. Accordingly, the magnets 156, 157, 158, 156', 157' and 158' relatively vibrate with respect to the hollow portions of the bobbins 156, 157, 158, 156', 157' and 158'. This relative vibration of the magnets with respect to the bobbin causes variation of magnetic flux of the magnets and by means of this variation of magnetic flux, electromotive force is induced at both ends of the coil 107 turned around the bobbin.

Between the convex parts 131, 132, 131' and 132' of the motion member 130 and the magnet holding plates 105 and 105', resilient members such as coil springs 161, 162,

161' and 162' are arranged. In the fronts of the convex parts 131, 132, 131' and 132' and in the fronts of the magnet holding plates 105 and 105', protrusions are provided respectively and the springs 161, 162, 161' and 162' are inserted to them between the convex parts and the holding plates.

With reference to Figs. 6 to 10, the mechanism of generating induced electromotive force in the coil 107 in the portable power-supply unit 100 of the present invention is explained.

Fig. 8 is a top view of this embodiment 100 where the upper cover 112 is removed.

The motion member 130 is arranged in the upper receiving room 113 to have spaces from both of the internal walls of the receiving room 113 and the springs 161, 162, 161 and 162' are arranged in the spaces as shown. Accordingly, when the case 110 is vibrated by an external movement on the case 110, the motion member 130 vibrates along its longitudinal direction by means of the elasticity of the springs 161, 162, 161 and 162' in the spaces formed in the receiving room 113 of the case 113. Then, the bobbins 151, 152, 153, 151', 152' and 153' attached in the convex parts 131, 132, 131' and 132' of the motion member 130 vibrate relatively with respect to the magnets 156, 157, 158, 156', 157' and 158' placed on their front.

As a result, in each of the coils 107 turned around the bobbins, the electromotive force is induced. (Faraday's law)

Here, the external movement refers to a movement exerted on the power-supply unit of the present invention from external when a user carries the power-supply unit.

For example, the external movement includes an artificial shaking of the power-supply unit by the user and shaking of the power-supply unit naturally caused when the user carries it. Another example is a vibration of a car. When the car moves, there is a vibration and this vibration can shake the portable power-supply unit placed inside the car.

The induced voltage in the coils of the bobbins is supplied to the charge control circuit 30 described with respect to the first embodiment and recited in Fig. 5 to adapt it to a battery 170. The charge control circuit 30 of Fig. 5 is installed in the circuit plate 120 of Fig. 6

Referring to Fig. 5, electromotive force induced in the coils of the bobbins is AC voltage. The charge control circuit 30 converts this AC voltage into DC voltage and steps up and stores the converted DC voltage in the super capacitor 34. Among the stored DC voltage in the super capacitor 34, some parts are supplied to a circuit of the portable appliance and other remaining parts are supplied to the secondary battery for chargeing.

Referring to Fig. 9, a contact for electrical connection 142 is exposed to the lower receiving room 115. The contact 142 is connected to the charge control circuit 30. The secondary battery 170 is placed in the lower receiving room 115 and a contact for the charge (not shown) provided in the secondary battery 170 comes in contact with the contact 142 connected with the charge control circuit 30. Therefore, the induced voltage in the coils of the bobbins is supplied to the battery 170 and charges it.

The portable power-supply unit 100 can have a portable part 180 as shown in Fig. 15. By the portable

part 180 formed in the upper cover 112, the user can hang the portable power-supply unit 100 on a belt of the user and he or she can carry the unit 100.

When the user travels, for example, he or she walks up steps, the external movement is naturally exerted on the portable power-supply unit 100 and the battery 170 is charged accordingly.

A third embodiment

The described second embodiment essentially includes the motion member in the case 110. However, this third embodiment recites a portable power-supply unit without the motion member. Figs. 11 and 12 show such an embodiment.

Fig. 11 shows a subcase 200 provided with an internal slot 210. As shown, in the internal slot 210, a magnet 220 and a bobbin 230 are placed. In the bobbin 230, a hollow 232 is formed through which the magnets 220 can pass. Also, a coil 231 is turned around the bobbin 230.

The length of the magnet 220 is shorter than that of the internal slot 210. A resilient member 240 such as a coil spring is arranged in the space formed between the magnet 220 and the internal slot 210. Protrusions 211 and 221 are formed on both ends of the magnet 220 and both internal walls of the slot 210, respectively for supporting the springs.

In an outer surface of the subcase 200, a contacts 201 is formed which is connected to the coil 231. The contact 201 is electrically connected to a charge control circuit having the structure shown in Fig. 5.

When the subcase 200 is exerted the external movement, the magnet 220 connected to the springs 240 vibrates forward and backward along the slot 210 through

the hollow 232 of the bobbin 230. Therefore, the coil 231 turned around bobbin 230 experiences variation of magnetic flux and electromotive force is induced in the coil.

Fig. 12 shows other modified example. In this case, a plurality of magnets 220, 240 and 260 and a plurality of bobbins 230, 250 and 270 are provided in the slots 210 and the springs 281, 282, 283 and 284 are interposed between the magnets 220, 240 and 260 and between the magnets 220 and 260 and the internal walls of the slot 210, respectively as shown. Both of the internal walls of the slot 210 have protrusions 211, respectively for fixing the springs 281 and 284.

In this case in Fig. 12, each voltage induced in the respective bobbin is totally added and large vibration displacement of the magnet is not necessary. That means, by means of a small vibration displacement, it generates the desired induced electromotive force.

The subcase 200 recited in Figs. 11 and 12 is provided in the upper receiving room 113 of Fig. 6 along with the charge control circuit 120 and they are closed by the upper cover 112 so that they are cased and forms a simple power module 100.

A fourth embodiment

The described embodiments show the portable power-supply units which have a separate receiving room for receiving the battery in the one case. However, this fourth embodiment shows a portable power-supply unit of the present invention without the receiving room for the battery.

Figs. 13 and 14 show the forth embodiment relating to a portable power-supply unit of the present invention.

This embodiment has the same basic constitution as

the second embodiment.

However, this embodiment does not have the circuit plate 120, the lower receiving room 115 for receiving the battery 170 and the lower cover 114 recited in Fig. 6. Instead, a battery 370 and a charge control circuit 360 are mounted on the inside of a motion member 330.

Fig. 13 is an exploded perspective view of the portable power-supply unit of the fourth embodiment 300 and Fig. 14 is a side sectional view taken along A-A line of Fig. 13.

The size of a case 310 is as large as a business card so that a user can easily hold. The case 310 includes a receiving room 320. The receiving room 320 is closed by a cover 340 having a detachable mounting protrusion 341. A detachable mounting portion 342 is formed in the case 310 to receive the protrusion 341. Bobbin holding plates 350 and 350' are arranged at both internal sides of the receiving room 320 as shown and fixing steps 321 and 322 are also formed on the bottom surface of the receiving room 320 to prevent the holding plates from escaping toward the central portion.

Bobbins 351, 352, 353, 351', 352' and 353' having the structure recited in Fig. 7 are attached to the front of the bobbin holding plates 350 and 350' as shown.

A motion member 330 is arranged in the receiving room 320. The motion member 330 is a rectangular shape plate on both ends of which a plurality of magnets 354, 355, 356, 354', 355' and 356' are attached in the locations corresponding to those of the Bobbins 351, 352, 353, 351', 352' and 353' attached to the bobbin holding plates 350 and 350'. Each of the magnets reciprocates through the hollow of the corresponding bobbin.

Between the bobbin holding plate 350 and 350' and the motion member 330, resilient members such as coil springs 357, 358, 357' and 358' are arranged.

In this embodiment, the bobbins 351, 352, 353 and 351', 352' and 353' are made of an alloy of duralumin and they have larger strength than those made of polymer if their sizes are the same each other. The coil turned around the bobbins is made of an enamel wire, the diameter of which is about 0.05 to 0.14 mm. It is possible to use a coil the diameter of which is about 1/1000 mm. It is more preferable if the diameter of the coil is smaller. The magnets 354, 355, 356, 354', 355' and 356' are permanent magnets magnetic flux density of which is up to 3000 gauss.

Inside of the motion member 330, the battery 370 and the charge control circuit 360 are provided as shown in Fig. 14. They are cased inside the motion member by means of molding.

A lithium ion battery is preferable for the battery 370. The charge control circuit 360 has the structure as shown in Fig. 5.

In a side of the motion member 330, an electrical connection means is formed for supplying the portable power supply unit with power charged from the battery 360.

This embodiment may have a portable part 180 shown in Fig. 15 as the second embodiment.

In this embodiment, the bobbins are fixed and the magnets attached on the motion member relatively vibrate with respect to the bobbins, which causes variation of magnetic flux in the coils around bobbins and generates the induced electromotive force in the coils. In the second embodiment, the magnets are fixed and the bobbins

relatively vibrate with respect to the magnets.

Also, this embodiment does not provide a separate receiving room for the battery and, instead, the battery is installed inside the motion member. Accordingly, the present embodiment can use its volume more efficiently than the second embodiment and, thus, can be minimized as much.

A fifth embodiment

In the embodiments described above, the means for generating induced electromotive force and the battery are simultaneously received in the same case. However, this structure could increase the weight of the case.

Accordingly, in this fifth embodiment, a case has only one receiving room in which only the means for generating induced electromotive force and the charge control circuit are provided.

A portable power-supply unit of this fifth embodiment basically has the structure the same as that of one among the first to fourth embodiments. However, in this embodiment, a battery is not provided therein. That is, it does not have a separate lower receiving room for the battery if the structure thereof is the same as that of the first to third embodiments. The motion member does not include the battery inside it if the structure of this embodiment is the same as that of the fourth embodiment.

In this embodiment, the battery is not included in the case and it is separated from the case. The portable power-supply unit has an electrical connection means taken out to the outside of the case and the electrical connection means is connected to the battery outside the case. Accordingly, the charging voltage converted through the charge control circuit 30(Fig. 5) is supplied to the

battery by means of the electrical connection means.

Below, the fifth embodiment will be explained with reference to Fig. 16.

The portable power-supply unit 400 of this embodiment includes means for generating induced electromotive force and a charge control circuit. The means for generating induced electromotive force includes the bobbin, magnet, and spring. In this embodiment, a battery is not provided in the portable power-supply unit 400 and it is separated from the unit 400 and mounted on a portable electronic appliance. The portable power-supply unit 400 has an electrical connection means taken out the outside of the unit 400, through which the portable power-supply unit 400 is connected to the battery mounted on the portable electronic appliance.

The electrical connection means 480 includes a flexible cable 482 and a jack 481 for connection. The portable electronic appliance on which the battery is mounted has a socket to receive the jack 481. The socket is electrically connected to the battery for the charging.

Accordingly, the connection of the jack 481 to the socket and the exertion of the external movement on the power-supply unit 400 charges the battery mounted on the electronic appliance.

Since the portable power-supply unit of this fifth embodiment does not include the battery on it, the weight of the portable power-supply unit is decreased. As a result, the lightness of the portable power-supply unit is accomplished.

A sixth embodiment

The above described embodiments show the relative vibration of the bobbin and the magnet for generating the

induced electromotive force. However, the other motion is possible for generating the induced electromotive force.

Fig. 17 shows such an example.

In this embodiment, an electrical connection means 580 is taken out from a spherical case 510 and the electrical connection means 580 is connected to the battery mounted on an electronic appliance when the battery is charged.

As shown in Fig. 17b, inside the spherical case 510, a rotator 591 round which a coil is wound is provided at its center and magnet 592 is arranged on the internal circumference of the case where the N pole and the S pole of the magnet are spaced from each other as shown. Therefore, the rotational movement of the case will generate induced electromotive force in the coil wound around the rotator 591. For example, the case is directed to a yoyo.

A seventh embodiment

Fig. 18 shows a portable-power supply unit which is used as a storage battery pack for a cellular phone. The storage battery pack refers to a pack on which the battery and its charging device are mounted as a unit. The storage battery pack is detachably mounted on the cellular phone.

Fig. 18 shows a storage battery pack 610 and a cellular phone 600 on which the storage battery pack 610 is mounted. The storage battery pack 610 is mounted on a space 630 for mount formed on the rear surface of the cellular phone 500 and the storage battery pack 610 is detachable to the cellular phone 500 because the storage battery pack 610 is combined with the cellular phone 500 through a detachable mount portion 620 formed in the upper

of the space 630 as shown.

When the storage battery pack 610 is mounted on the cellular phone 500, an electrical contact 611 of the storage battery pack 610 comes in contact with an electrical contact of the cellular phone 500, which accomplishes the electrical connection of the storage battery pack 610 to the cellular phone 500.

The internal structure of the storage battery pack 610 is the same as that of one among the second embodiment to fourth embodiment. The structure of the fourth embodiment is preferred for the storage battery pack 610. Therefore, the specified structure of the storage battery pack 610 can be recognized from the structure of the above embodiments and is not described.

In this embodiment, the storage battery pack 610 is detachably mounted on the cellular phone 500. The storage battery pack 610, however, can be integrally incorporated into the cellular phone 500 and they can constitute one unit.

The described all seven embodiments are available for all kinds of a portable electronic appliance such as a portable communication terminal equipment, a portable cassette player, a portable CD player, electronic notebooks, pagers, FM multi broadcasting receivers, etc.

This invention developed an energy for a portable electronic appliance from a vibration caused by the movement of a user. The vibration was useless before the development of the present invention. In this point, the present invention is significant.

Especially, the present invention enhanced the stable supply of power to a portable communication terminal equipment and a portable computer which are core

communication means in future. Also, the present invention enhanced the portability of them.

The user of the portable power-supply unit of the present invention can supply power to an electronic appliance only by means of the carry of it.

The present invention is easily available for a cellular phone as a storage battery pack, which maximize the convenience and the portability of the cellular phone.

What is claimed is:

1. A portable power-supply unit comprising:

(a) a case;

(b) a means for generating induced electromotive force mounted on the case; and

(c) a charge control circuit mounted on the case which adapts the induced electromotive force generated by the means for generating induced electromotive force to an external circuit by means of step up of the voltage of the induced electromotive force or rectification; wherein the means for generating induced electromotive force includes magnetic flux-generating means, a coil electromagnetically coupled to the magnetic flux-generating means, and moving means for developing a relative motion between the magnetic flux-generating means and the coil by means of an external movement exerted on the case.

2. The portable power-supply unit as recited in claim 1, wherein said case includes a first room for receiving the means for generating the induced electromotive force and said charge control circuit and a second room for receiving a secondary battery and the charge control circuit and the secondary battery is electrically connected to each other.

3. The portable power-supply unit as recited in claim 2, wherein said moving means includes a resilient member for converting the external movement into vibration, and continuously keeping up this vibration and a motion member received in the first room which takes a vibrating motion by the movement of the resilient member.

4. The portable power-supply unit as recited in claim 3, wherein a holding plate for holding said magnetic-flux generating means is provided in an inside wall of said first room, and said coil is wound around a bobbin attached to said motion member, and said bobbin and said magnetic-flux generating means are arranged to be opposite to each other so that they take a relative motion each other to be closer and farther repeatedly according to the vibration of said motion member.

5. The portable power-supply unit as recited in claim 2, wherein a subcase is formed in said first room to separately receive said induced electromotive force generating means, the magnetic-flux generating means is a magnet, the moving means is coil springs arranged at both ends of the magnet and the coil is wound round a bobbin which has a hollow to receive the magnet so that the magnet reciprocally vibrates with respect to the coil-wound bobbin through its hollow when the external movement exerts on the case.

6. The portable power-supply unit as recited in claim 5, wherein a multiple of the means for generating induced electromotive force are arranged in series in an internal slot of the subcase.

7. The portable power-supply unit as recited in claim 1, wherein

(a) the case includes a receiving room for receiving the magnetic-flux generating means, the coils and the moving means;

(b) the moving means includes a resilient member for

converting the external movement to vibration, and continuously keeping up this vibration and a motion member which takes a vibrating motion by the movement of the resilient member in the receiving room; and

(c) the secondary battery and the charge control circuit are mounted on the interior of the motion member and they are electrically connected to each other.

8. The portable power-supply unit as recited in claim 7, wherein

a holding plate for holding a bobbin round which the coil is wound is provided in an inside of the receiving room and a magnetic-flux generating means is attached to the motion member; and

the bobbin and the magnetic-flux generating means are arranged to be opposite to each other so that they take a relative motion each other to be closer and farther repeatedly according to the vibration of the motion member.

9. The portable power-supply unit comprising:

a case;

a means for generating induced electromotive force mounted on the case including magnetic flux-generating means, a coil electromagnetically coupled to the magnetic flux-generating means, and moving means for developing a relative motion between the magnetic flux-generating means and the coil by an external movement exerted on the case;

a charge control circuit mounted on the case which adapts the induced electromotive force generated by the means for generating induced electromotive force to an external circuit by means of step up of the voltage of the

induced electromotive force or rectification; and

an electrical connection means taken out from the case, whereby electrically connecting the charge control circuit to a battery outside the case for supplying the charging voltage to the battery.

10. The portable power-supply unit as recited in any of claims 1 to 9, wherein the charge control circuit includes

(a) a rectification circuit which converts the induced AC voltage from the means for generating induced electromotive force into DC voltage;

(b) a voltage-step up circuit for stepping up the level of the rectified DC voltage in order to adapt the rectified DC voltage to an external circuit; and

(c) a super capacitor which temporarily stores the stepped up voltage and supplies the stored voltage into the secondary battery.

11. The portable power-supply unit as recited in claim 10, further comprising a super capacitor for compensation parallely connected to the secondary battery in order to prevent the life span of the battery from being shortened because of the abrupt all discharge of the secondary battery.

12. The portable electronic appliance which mounts a power-supply unit as recited in any of claims 1 to 11.

13. The portable electronic appliance as recited in claim 12, wherein the portable power-supply unit is detachably mounted on the portable electronic appliance.

14. A storage battery pack in capable of portably charging a portable electronic appliance comprising:

(a) a case detachably mounted on a portable communication terminal equipment;

(b) means mounted on the case for generating induced electromotive force by means of an external movement exerted on the case;

(c) a charge control circuit mounted on the case for adapting the induced voltage to the charging of a secondary battery, the battery being mounted on the case and electrically connected to the charge control circuit; and

(d) an electrical connection means exposed on the outer surface of the case and electrically connected to the charge control circuit, the electrical connection means being in contact with a contact of an electronic appliance when the storage battery pack is mounted on the electronic appliance.

15. The storage battery pack as recited in claim 14, wherein

(a) the case includes an internal slot; and

(b) the means for generating induced electromotive force includes

i) a magnet provided in the internal slot of the case;

ii) a motion member arranged in the internal slot of the case, the length of which is shorter than is shorter than that of the internal slot;

iii) a bobbin around which a coil is turned, the bobbin provided in a face of the motion member to be opposite to the magnet; and

iv) a resilient member arranged in space formed between the motion member and the internal wall of the internal slot

16. The storage battery pack as recited in claim 15, wherein a plurality of the magnets are attached to the internal slot along its internal wall and a plurality of the bobbins are arranged at the locations corresponding to those of the magnets.

17. The storage battery pack as recited in claim 14, wherein

(a) the case includes an internal slot; and

(b) the means for generating induced electromotive force includes

i) a bobbin provided in the internal slot of the case, the bobbin around which a coil is turned;

ii) a magnet arranged at the hollow of the bobbin; and

iii) a resilient member associated with the magnet and supported by the internal slot

18. The storage battery pack as recited in claim 17, wherein a plurality of the bobbins are provided in series inside the internal slot, a plurality of the magnets are provided inside the hollows of the bobbins in series with spaces therebetween, and a plurality of springs are arranged in the spaces between the magnets.

19. The storage battery pack detachably mounted on a portable communication terminal equipment comprising:

(a) a case of the storage battery pack provided a

plurality of rectangular spaces provided in the outer surface thereof; and

(b) a means for generating induced electromotive force including a resilient member for maintaining vibration developed naturally or artificially, a permanent magnet, and a coil electromagnetically coupled to the magnet, all of which are provided in each of the space, wherein the resilient member is fixed to the end of the magnet to vibrate the magnet, the coil wraps the magnet so that the magnet is in capable of reciprocating through the inside of the coil, and, accordingly, the electromotive force is induced at both ends of the coil when the permanent magnet connected to the resilient member relatively reciprocates with respect to the coil according to the vibration of the storage battery pack; and

(c) a charge control circuit for adapting the induced voltage to the charging of a secondary battery.

20. The storage battery pack as recited in claim 19, wherein the rectangular spaces are arranged laterally and longitudinally in the outer surface of the case of the storage battery pack.

FIG. 1A

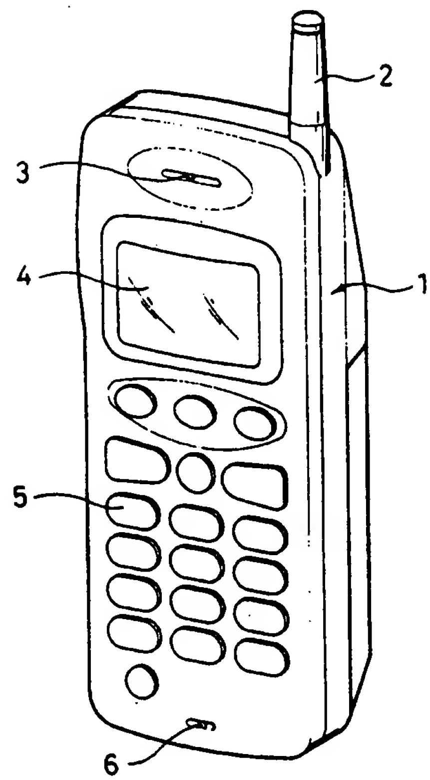


FIG. 1B

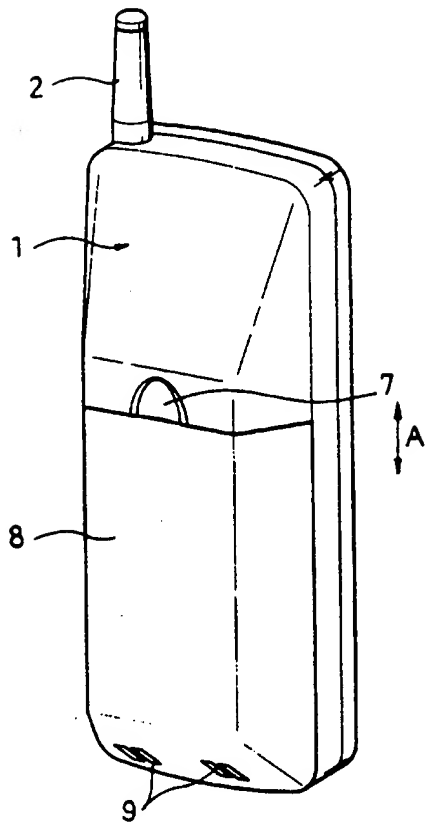


FIG. 1C

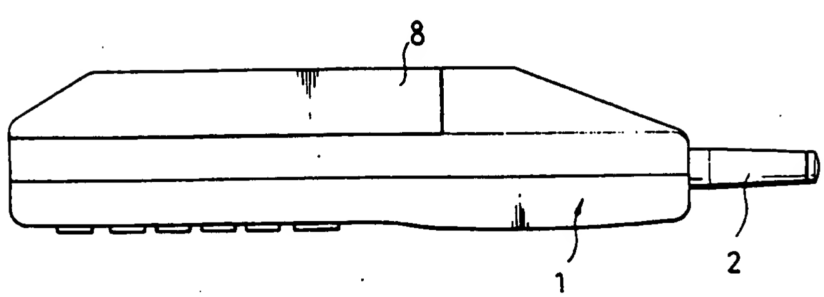


FIG. 2A

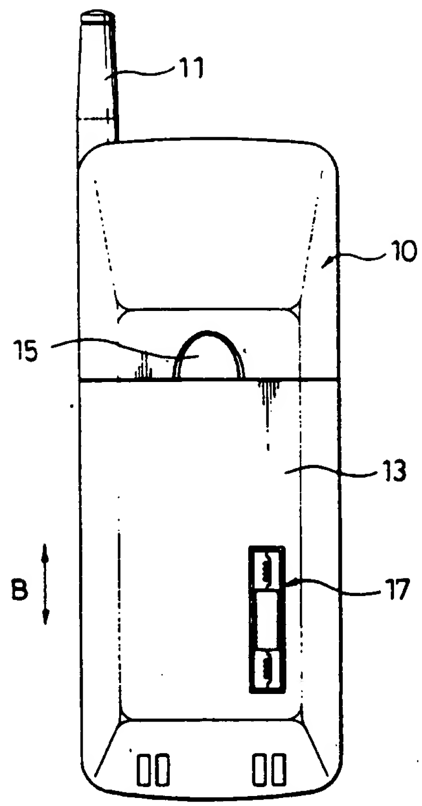


FIG. 2B

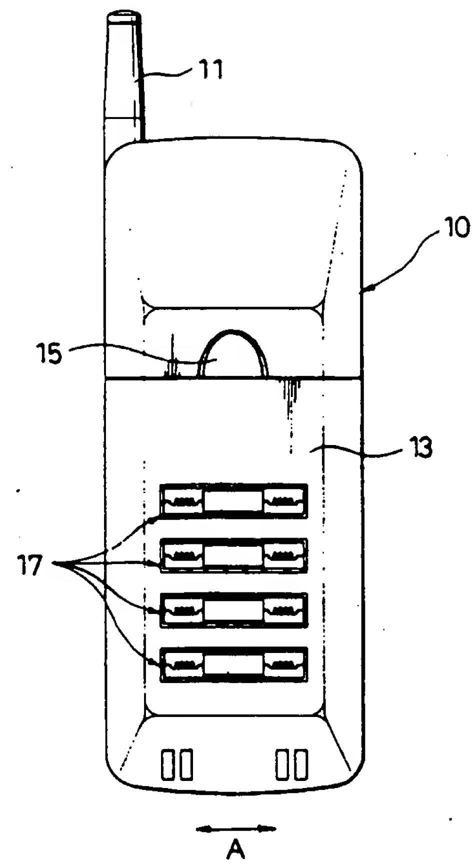


FIG. 2C

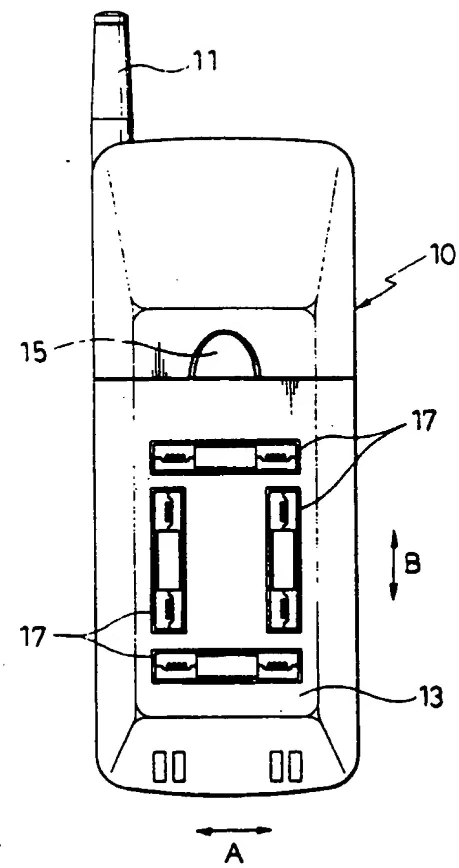


FIG. 3

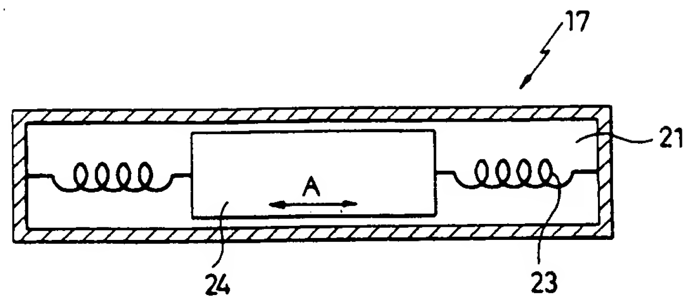


FIG. 4

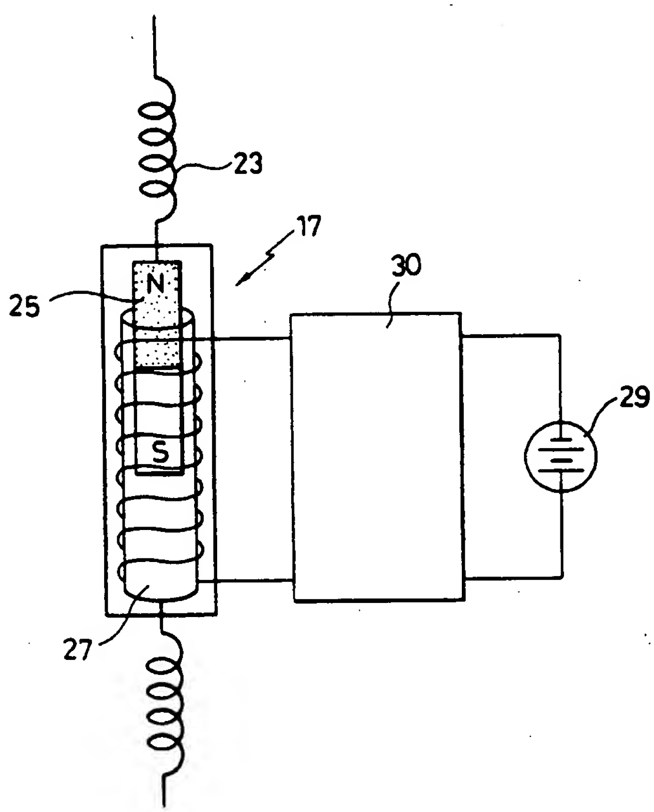


FIG. 5

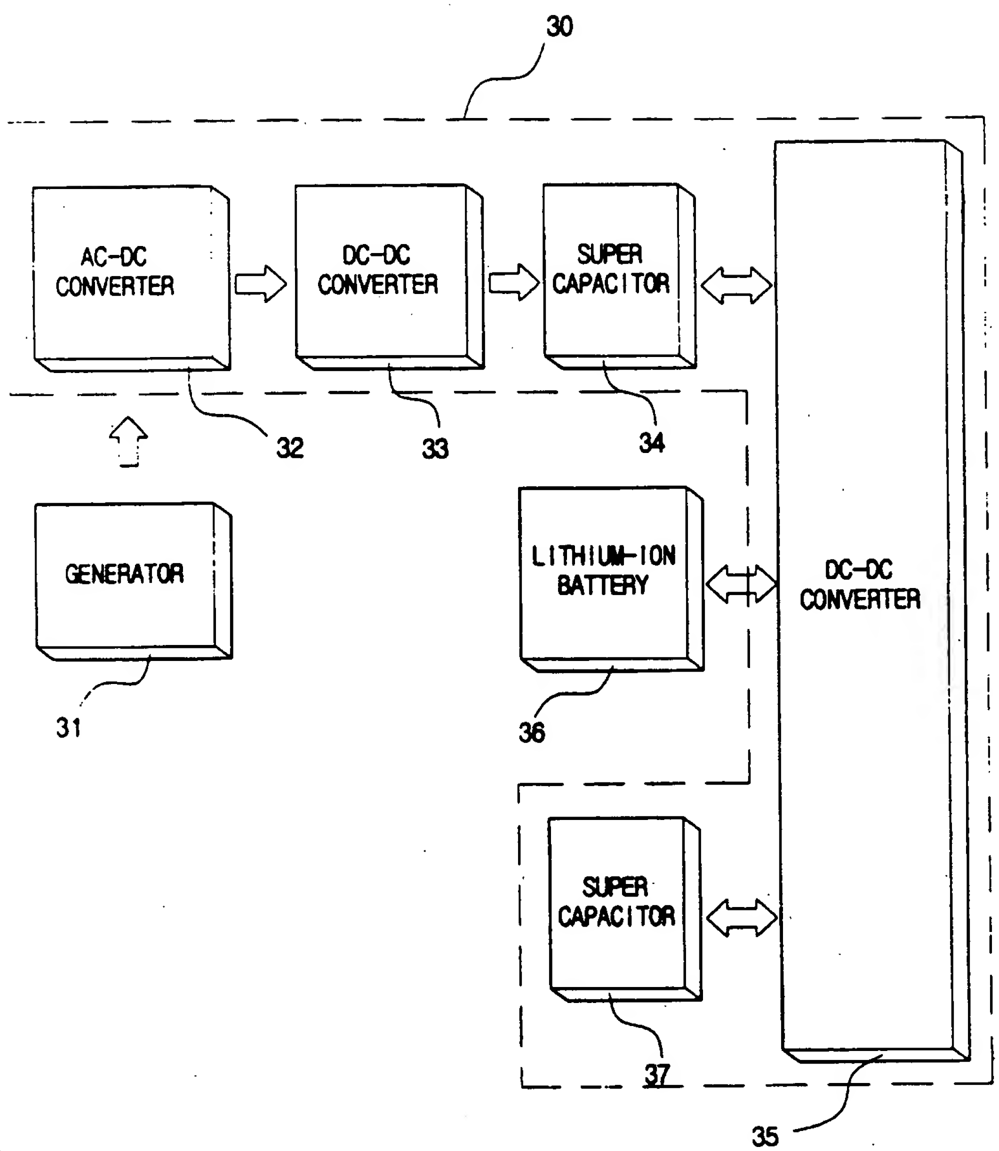

30
AC-DC CONVERTER
DC-DC CONVERTER
SUPER CAPACITOR
32
33
34
GENERATOR
31
LITHIUM-ION BATTERY
36
DC-DC CONVERTER
SUPER CAPACITOR
37
35

FIG. 6

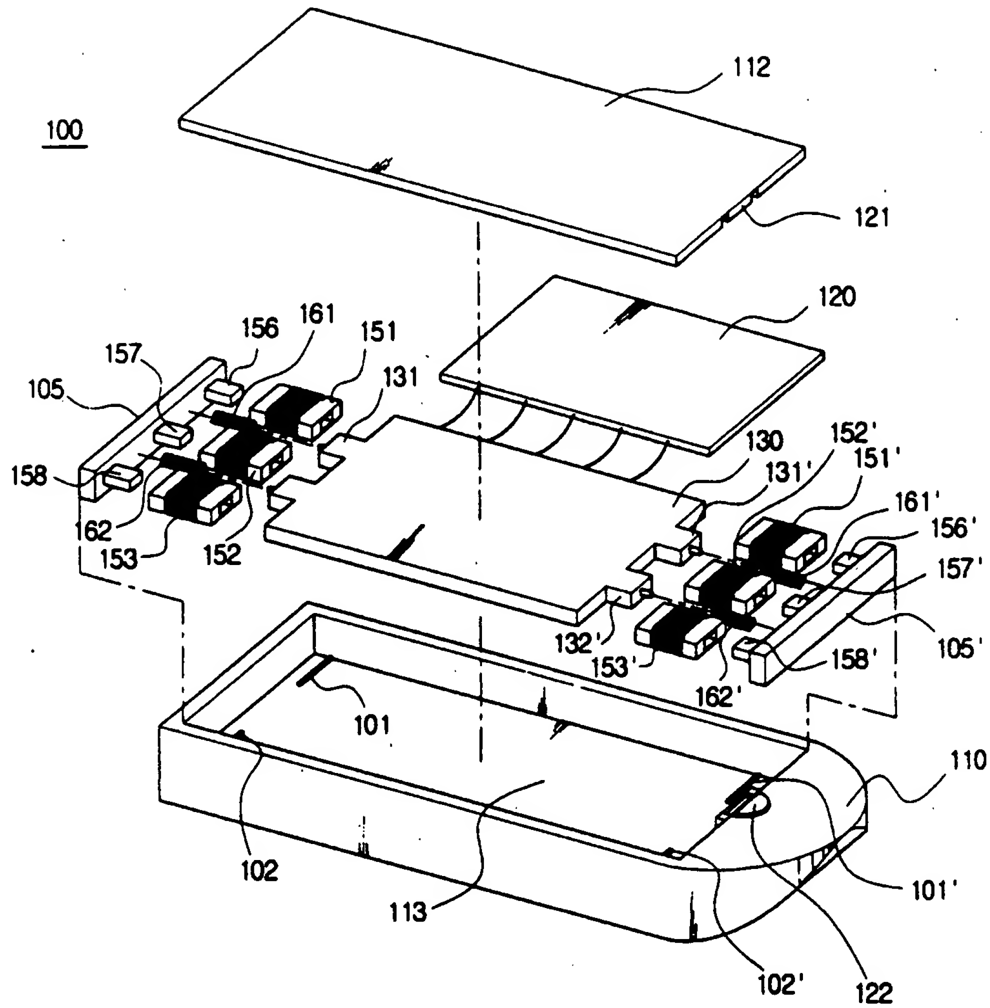

100
112
121
120
156
161
151
157
131
105
130
152'
151'
158
131'
161'
162
156'
153
152
157'
132'
153'
158'
105'
162'
101
110
102
101'
113
102'
122

FIG. 7

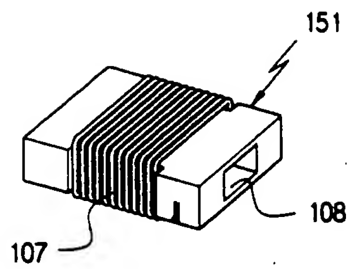

151
108
107

FIG. 8

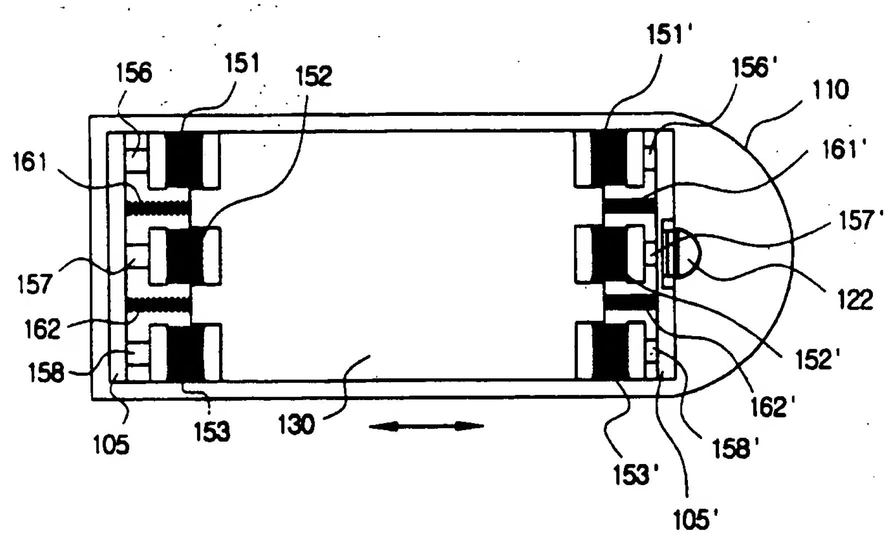

151'
156'
110
156
151
152
161
161'
157'
157
122
162
152'
158
162'
105
153
130
158'
153'
105'

FIG. 9

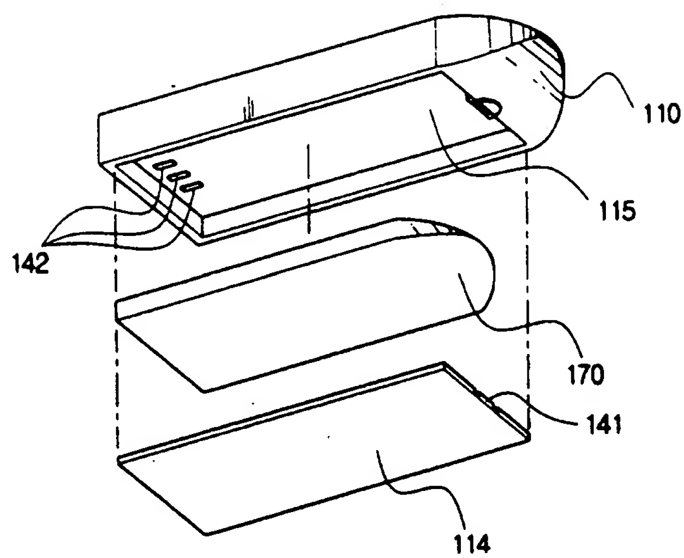

110
115
142
170
141
114

FIG. 10

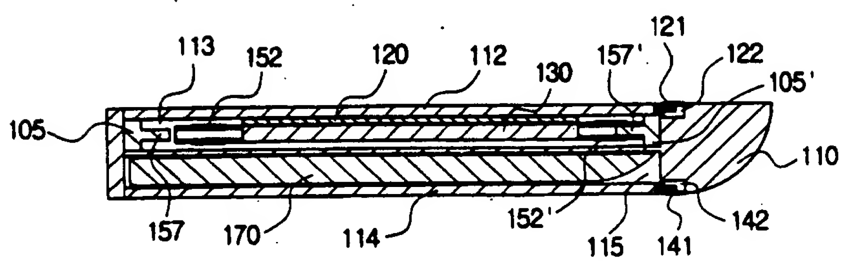
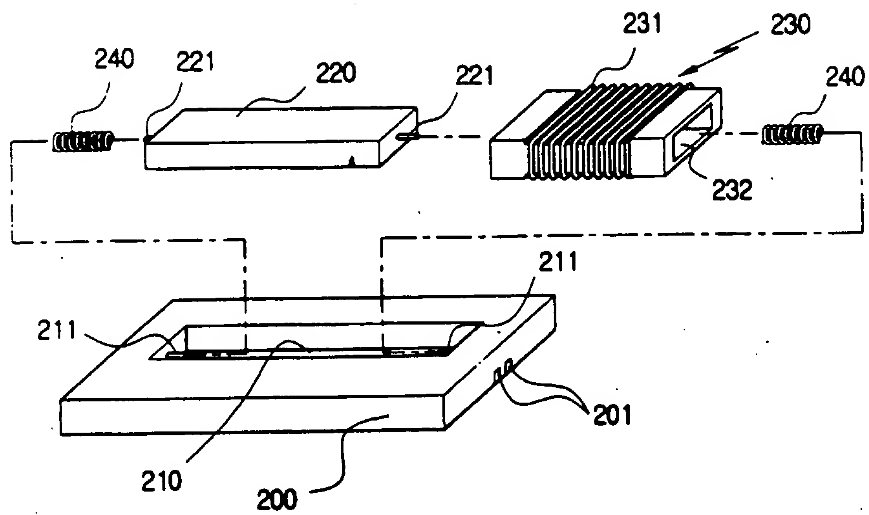

113
152
120
112
130
157'
121
122
105'
105
110
157
170
114
152'
115
141
142

FIG. 11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221
220
221
231
230
240
232
211
211
201
210
200

FIG. 12

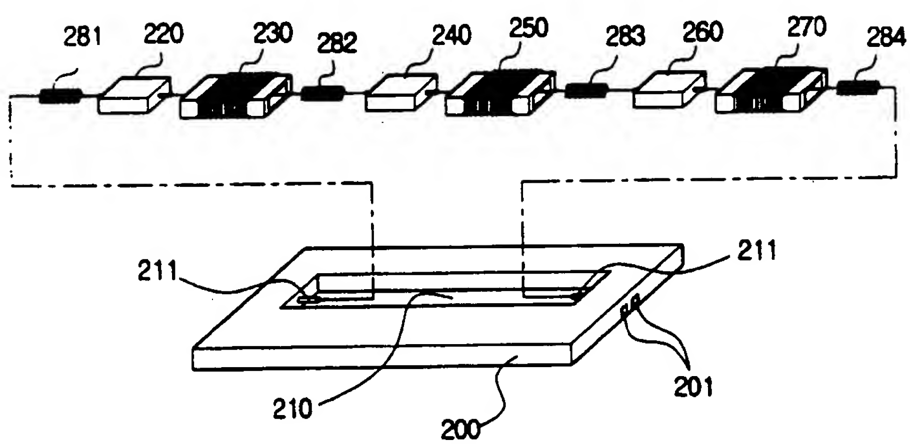

281
220
230
282
240
250
283
260
270
284
211
211
201
210
200

FIG. 13

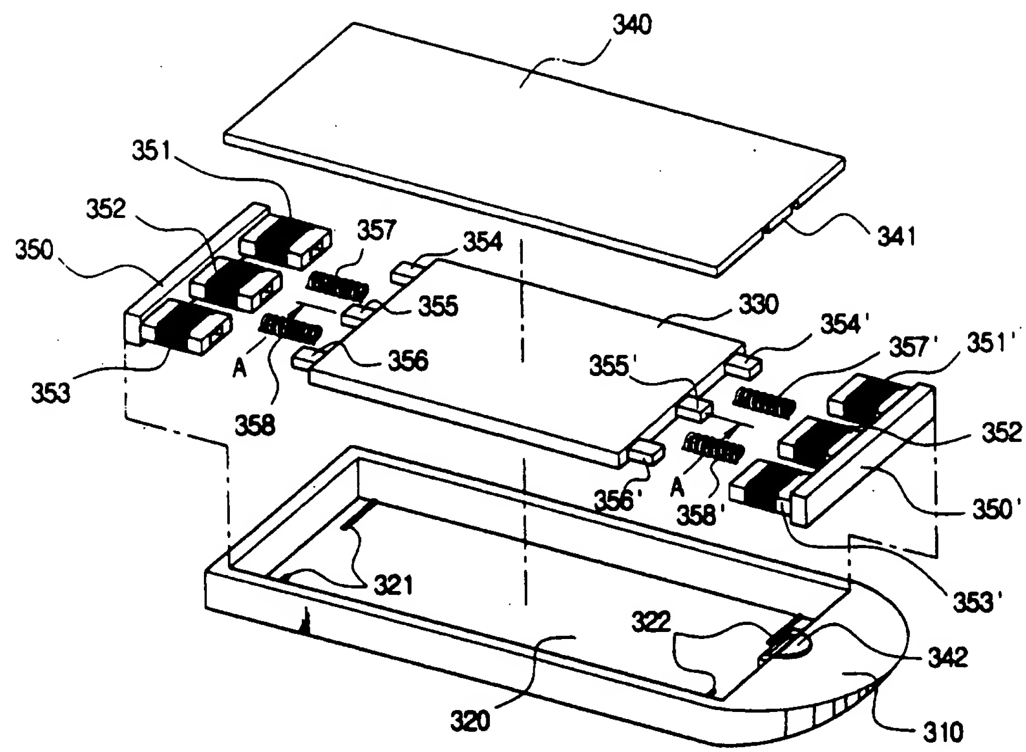

340
341
351
352
350
353
357
354
355
356
A
358
330
354'
357'
351'
355'
352'
356'
A
358'
350'
353'
321
322
342
320
310

FIG. 14

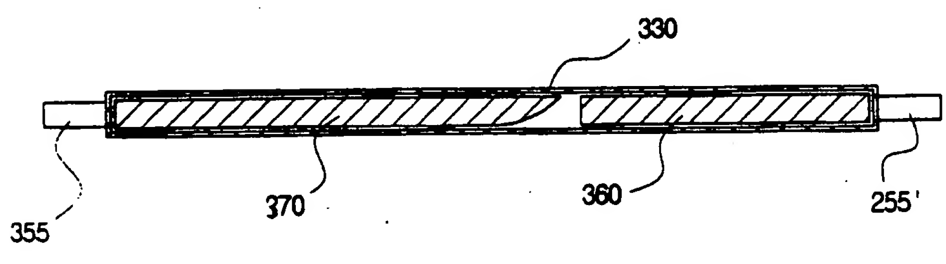

330
355
370
360
255'

FIG. 15

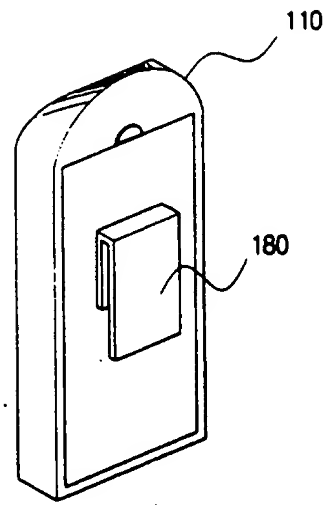


FIG. 16

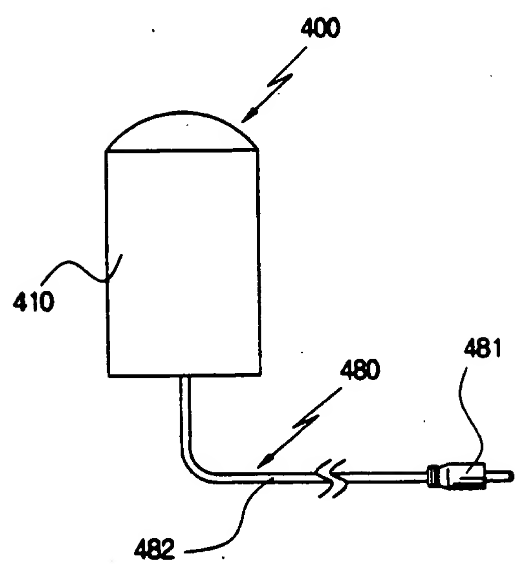


FIG. 17A

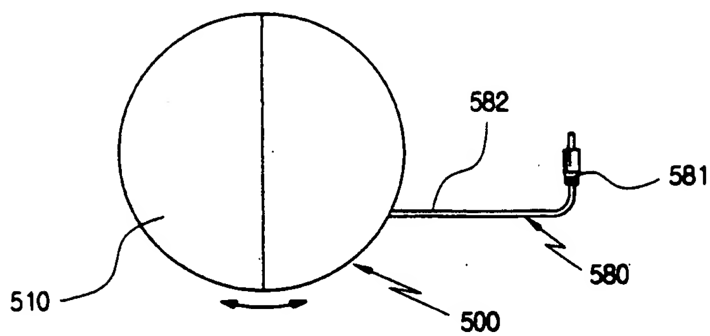


FIG. 17B

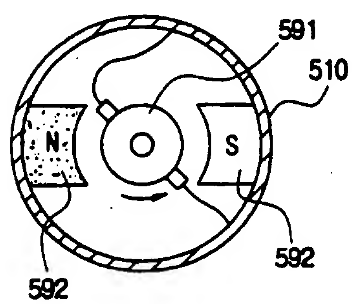
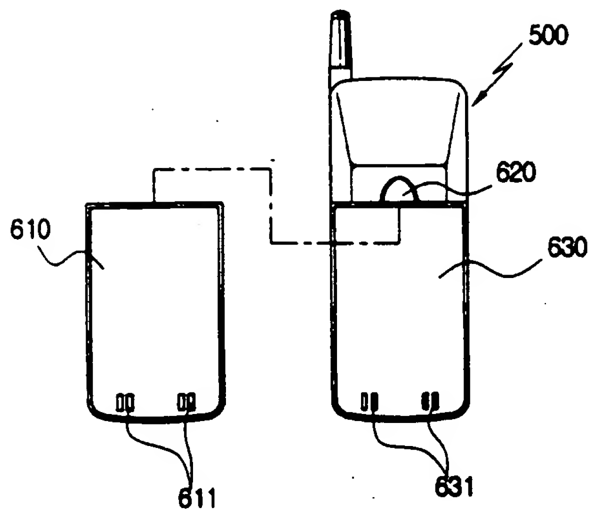


FIG. 18



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR 99/00629

A. CLASSIFICATION OF SUBJECT MATTER

IPC^7: H 01 M 10/46

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC^7: H 01 M, H 04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

Questel WPI and EPODOC, STN-PATDPA, IBM-Priv. Prop. Network

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 09-219653 A (NIPPON AVIONICS) 19 August 1997 (19.08.97) (abstract). [online] [retrieved on 06 March 2000 (06.03.00)]. Retrieved from: IBM-Priv. Prop. Network Database in Internet; abstract. ----	1-20

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
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„E" earlier application or patent but published on or after the international filing date
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„O" document referring to an oral disclosure, use, exhibition or other means
„P" document published prior to the international filing date but later than the priority date claimed
„T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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„Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
„&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
06 March 2000 (06.03.00)	22 March 2000 (22.03.00)
Name and mailing adress of the ISA/AT Austrian Patent Office Kohlmarkt 8-10; A-1014 Vienna Facsimile No. 1/53424/200	Authorized officer Stepanovsky Telephone No. 1/53424/135

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/KR 99/00629

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP A2 9219653	19-08-1997	none	